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present color either black or black with a white belt (Day). White spotting other than belts appear, also an excessive white belting condition covers all but the extremities of the ears and the tail. Spillman states that ten per cent. of the progeny of registered individuals are without belted areas. He supposes two types of belting (*a*) homozygous, occurring very rarely, and (*b*) heterozygous, occurring as the common type. In crosses of other breeds on Hampshires (Simpson) (Severson) the spotting condition proved to be heterozygous, for when bred to recessive colored breeds the ratio of belts to non-belts was 11–10 (expected ratio 10.5–10.5).

Summing up all evidence so far on the inheritance of belting spotting one would be safe in saying that this character is due to a single heterozygous factor pair Ss for white spotting.

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STANDARDIZED MICROPHOTOGRAPHY

THIRD CONTRIBUTION: THE EXPOSURE FACTOR

THE great convenience to be derived from the use of only two tables of factors is so apparent that anybody who is at all familiar with microphotographic work should not for a moment hesitate to spend some time in the preparation of such tables. It is, of course, natural that differences in the source of light, optical equipment and ray-filters necessitate the preparation of new tables. Our own outfit being one of the standard Bausch and Lomb apparatus with a Zeiss microscope and Cramer ray-filters, it occurred to me that those possessing a similar equipment might be spared the tediousness of preparing an exposure table if our table of exposure factors were published with such instructions as would permit of identical arrangement of the apparatus. Moreover, it will be remembered that these factors are dependent upon the source of light, substage position, magnification, and numerical aperture of the objective, and that other conditions being identical, exposure varies as the square of the numerical aperture.

A word must be said about the use of the substage condenser. The position of the condenser indicated in the table is such as to give the greatest detail without *apparent* bad effect on definition. As is well established, the depth of focus in a microscopic objective depends upon its numerical aperture. The greater the latter, the smaller the depth of focus. Since definition increases with numerical aperture, one has to sacrifice the one or the other. From a practical point of view depth of focus is often more desirable than perfect definition. The numerical aperture of an objective may be conveniently cut down by increasing the distance between the substage condenser and the objective. This can be done with safety only to a certain point, which I called the optimum, and beyond which definition is visibly impaired. I hope to be able later to return to this subject in greater detail. Meanwhile, we may state as a general rule that the higher the magnifying power of an objective, the sooner the optimum will be reached. With other words, the substage may be lowered a great deal more in low-power than in high-power objectives. In the following table the position of the substage is indicated in millimeters, assuming that it is at zero when moved up as far as it will go. In the Zeiss microphotographic stand the substage condenser has a numerical aperture of 1.40, and when placed at zero the surface of its upper lens is still 0.8 mm. below the surface of the microscopic table.

The source of light for which the table of exposure factors holds good is the Bausch and Lomb Microprojector No. 4301 with hand feed arc lamp and rheostat for 4.5 amperes, 110 volts, D.C., placed so that the distance between the uprights carrying the projector and the microscope table is 20 inches, while halfway between the projector and the microscope a water cell is placed for the absorption of heat rays. The projector has a movable condenser of its own. The position of this condenser influences the intensity of light. Our table is made for such a position of this condenser that the light on the focusing screen is brightest. It is not the same for every objective and must be found by experimenting, with the aid of an assistant, who moves the condenser while the observer watches the field. For this experiment the microscope substage is best lowered about 2 mm. to insure even illumination. When the position of the condenser of the projector has been found and marked on the mounting,

TABLE OF EXPOSURE FACTORS FOR ORTHONON PLATES WITHOUT RAY-FILTER, USED WITH A B. & L. OPEN ARC D.C. 110 VOLT MICROPROJECTOR AND AN ABBE SUBSTAGE CONDENSER WITH N.A. 1.40.

Linear Magnification.	B. & L. Achromat E. F. 32 N. A. 0.10 Substage completely removed.	B. & L. Achromat E. F. 16 N. A. 0.25 Substage lowered 8 mm.	Zeiss Apochromat E.F. 16 N. A. 0.30 Substage lowered 8 mm.	B. & L. Achromat E. F. 8 N. A. 0.50 Substage lowered 5 mm.	Zeiss Apochromat E. F. 8 N. A. 0.65 Substage lowered 5 mm.	B. & L. Achromat E. F. 4 N. A. 0.85 Substage lowered 4 mm.	Zeiss Apochromat E. F. 4 N. A. 0.95 Substage lowered 4 mm.	B. & L. Achromat E. F. 1.9 N. A. 1.30 Zeiss Apochrom't E. F. 2 N. A. 1.30 oil immersion Substage lowered 1.5 mm.
25	0.0005							
30	0.0007							
40	0.0013							
50	0.0020							
75	0.0045	0.013	0.011					
100	0.0080	0.024	0.020					
125		0.037	0.031					
150		0.054	0.045					
175		0.073	0.061					
200		0.096	0.080					
250		0.150	0.125					
300		0.216	0.180	0.108	0.090	0.048	0.040	
350		0.294	0.245	0.147	0.122	0.065	0.054	
400		0.384	0.320	0.192	0.160	0.085	0.071	
500				0.300	0.250	0.133	0.111	0.040
600				0.432	0.360	0.192	0.160	0.058
700				0.588	0.490	0.262	0.218	0.078
800						0.351	0.284	0.102
900						0.432	0.360	0.130
1000						0.532	0.444	0.160
1250								0.250
1500								0.360
1750								0.490
2000								0.640
2500								1.000
3000								1.440

the experiment need never be repeated again. The table itself applies only to an Orthonon plate used without ray-filter. For use with Cramer's rayfilters the factors given in this table must be multiplied by the factors shown in my first paper.

The so-called "Pointolite" is an excellent source of light for low powers. It requires about 5–10 times longer exposures. In our laboratory we use the Complete Illuminating Apparatus with D.C. open arc. After some experimenting it was found that the most satisfactory arrangement of this illuminating system is when the arc is moved forward to within 2½ inches from the first condensing lens, a water cell placed between second and third condensing lenses, in contact with the mounting of both, and the distance between the third and fourth condensing lens fixed at 15 inches, while the distance from the latter to the microscope table is 7½ inches. Under these conditions the exposure is double that obtained with the microprojector for which the table in this paper is given. I omit giving a separate table for this system, because any one may obtain it in a moment by simply doubling the values given here. But it must be remembered that change in the arrangement of the illuminating system, no matter how small the deviation, will result in wrong values.

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